Missouri Department of Natural Resources
Water Pollution Control Program

Total Maximum Daily Load (TMDL)

for

Howell Creek
Howell County, Missouri

Completed December 26, 2000
Approved January 31, 2001

Total Maximum Daily Load (TMDL)
For Howell Creek
Pollutant: Chlorine

Name: Howell Creek

Location: Near West Plains in Howell County, Missouri

Hydrologic Unit Code (HUC): 11010010-010001

Water Body Identification (WBID): 2582

Missouri Stream Class: C (Class C streams may cease to flow in dry periods but maintain permanent pools which support aquatic life.)[1]

Beneficial Uses: Livestock and Wildlife Watering, Protection of Warm Water Aquatic Life and Human Health-Fish Consumption

Size of Impaired Segment: 0.3 mile

Location of Impaired Segment: From W ½ Section 24, T24N, R8W (upstream) to NE ¼ Section 27, T24N, R8W (downstream)

Pollutant: Chlorine

Pollutant Source: West Plains Municipal Wastewater Treatment Plant

Permit Number: NPDES Permit No. MO-0096610

TMDL Priority Ranking: Medium

1. Background and Water Quality Problems

Howell Creek immediately below the outfall of the West Plains wastewater treatment plant (WWTP) was inspected by the Missouri Department of Natural Resources (MDNR) Water Pollution Control Program staff during summer low flow conditions in 1983, 1986 and 1993. In the 1993 survey, chlorine odor was detected and sewage sludge deposits were observed. Experience shows that when an odor of chlorine is present, there is more than enough chlorine to cause toxicity in the stream. Though usually rocks are bleached in the presence of too much chlorine, any bleaching was masked by the presence of the sludge. Additionally, there was no aquatic life immediately below the outfall and reduced benthic diversity further downstream. Based on these observations, 0.3 mile of the stream was judged to be impaired due to chlorine toxicity.

[1] See 10 CSR 20-7.031(1)(F)

The source of the chlorine is believed to be the West Plains WWTP since that facility uses chlorine to disinfect wastewater. Also, during the 1993 stream inspection, there was no upstream flow and thus no upstream source. The odor of chlorine was noticed downstream. These observations support the conclusion that the WWTP is the source of the chlorine.

The West Plains WWTP is served by an oxidation ditch wastewater treatment plant with a design flow of 3.875 cubic feet per second (cfs). The discharge is regulated by NPDES permit number MO-0096610, which was issued October 25, 1996, and expires October 24, 2001. Disinfection of wastewater at this facility down to the level of 400 colonies/100 ml monthly average and 1000 colonies/100 ml daily maximum is required by the Missouri effluent regulation 10 CSR 20-7.015 (4)(B)4. If chlorine is used as a disinfectant, 10 CSR 20-7.015 (4)(B)5 requires dechlorination of the effluent if the outfall is within one mile of a classified stream and the $7Q10^2$ low flow of the receiving stream is less than 50 times the volume of the effluent design flow. Since the West Plains WWTP effluent discharge is to a classified stream with a 7Q10 low flow of zero, dechlorination is required. Dechlorination was not required in the latest permit, set to expire in 2001.

The discharge is located in the SE NE Section 27, T24N, R8W. Howell Creek is classified as a "losing stream", one that loses much or all of its flow to the groundwater system. This "losing stream" classification does not affect the chlorine standard. Most of the other streams in the upper portion of the watershed are also "losing streams" and much of this flow emerges about 20 miles away at Mammoth Spring in Arkansas, the second largest spring in the Ozark province of Missouri and Arkansas. The mouth of Mammoth Spring is a short distance across the MO-AK state line at the head of Spring River. On the surface, Howell Creek flows into the Warm Fork of the Spring River.

2. Description of the Applicable Water Quality Standards and Numeric Water Quality Targets

Designated Uses:
The designated uses of this section of Howell Creek, WBID 2582, are Livestock and Wildlife Watering, Protection of Warm Water Aquatic Life and Human Health-Fish Consumption. The stream classifications and designated uses may be found at 10 CSR20-7.031 (1)(C) and Table H.

Anti-degradation Policy:
Missouri's Water Quality Standards include the EPA "three-tiered" approach to anti-degradation, and may be found at 10 CSR 20-7.031(2).

Tier I defines baseline conditions for all waters -- it requires that existing beneficial uses are protected. TMDLs would normally be based on this tier, assuring that numeric criteria (such as dissolved oxygen, ammonia) are met to protect uses.

Tier II requires no degradation of high-quality waters, unless limited lowering of quality is shown to be necessary for "economic and social development." A clear implementation policy

[2] The 7-day average minimum flow with a recurrence interval of 10 years. Indicates drought conditions.

for this tier has not been developed, although if sufficient data on high-quality waters are available, TMDLs could be based on maintaining existing conditions, rather than the minimal Tier I criteria.

Tier III (the most stringent tier) applies to waters designated in the water quality standards as outstanding state and national resource waters; Tier III requires no degradation under any conditions. Management may require no discharge or prohibition of certain polluting activities. TMDLs would need to assure no measurable increase in pollutant loading.

This TMDL will result in the protection of existing beneficial uses, which conforms to Missouri's Tier I anti-degradation policy.

Specific Criteria and Numeric Water Quality Target:
The specific criteria for chlorine are found in Missouri's Water Quality Standards (WQS), 10CSR 20-7.031 Table A, page 17. The criteria for Warm Water Streams were used. The only beneficial use with chlorine criteria is protection of aquatic life. These criteria are 0.01 mg/L chronic and 0.019 mg/L acute, expressed as Total Residual Chlorine (TRC).

The numeric water quality target for this TMDL will be the 0.01 mg/L chronic standard applied at the end of the pipe.

3. Calculation of Load Capacity

Load capacity is defined as the maximum pollutant load that will still attain water quality standards. In this TMDL, the load capacity will be defined by the conditions leading to the highest instream level of TRC. These conditions would occur when the WWTP is running at full capacity and there is no upstream flow to dilute the effluent. Under these conditions, the chronic standard of 0.01 mg/L would need to be met. The formula for load capacity is given below:

(design stream flow in cfs)(maximum allowable pollutant concentration in mg/L)(5.395) = pounds/day*
*5.395 is the constant used to convert cfs times mg/L to pounds/day.

Given a design upstream flow of zero and a WWTP design flow of 3.875 cfs, solving this equation gives: (3.875 cfs)(0.01 mg/L)(5.395) = 0.209 pounds/day TRC.

4. Load Allocation (Nonpoint Source Load)

There are no known nonpoint sources of TRC in the impaired stream segment. Thus the nonpoint source load allocation for TRC is zero pounds per day.

5. Waste Load Allocation (Point Source Loads)

The point source waste load allocation (WLA) would be calculated by the formula :

(WWTP design flow in cfs)(effluent TRC limit in mg/L)(5.395) = TRC pounds/day

This formula gives (3.875cfs) (0.01 mg/L) (5.395) = 0.209 pounds/day as the WLA.

6. Margin of Safety

The Margin of Safety (MOS) is implicit based on the following conservative assumptions. The Wasteload Allocation calculation assumes the critical low flow of zero when the West Plains WWTP is discharging at a magnitude as high as its design flow. This circumstance would be a rare occasion. Also, Howell Creek is effluent dominated, therefore the water quality is really the West Plains effluent quality. The permit monitoring will provide assurance that the WQS will be achieved and therefore provides another degree of conservatism in the TMDL.

7. Seasonal Variation

Because the impairment is due to a single point source, and there are no nonpoint sources, the consideration of the critical low flow takes into account seasonality. It would be at that low flow where concern would arise as to not meeting the chlorine permit limit and thus violating Missouri Water Quality Standards.

8. Implementation and Monitoring Plans

This TMDL will be implemented through permit action. West Plains NPDES permit MO-0096610 was re-issued October 25, 1996, with chlorination required, but no TRC limits. The permit will be modified to include the requirement of dechlorination, with a monthly average and daily maximum of 0.01 mg/L TRC and quarterly monitoring of TRC in the effluent. As with all of Missouri's TMDLs, if continuing monitoring reveals that water quality standards are not being met, the TMDL will be reopened and re-evaluated. This TMDL will be incorporated into Missouri's Water Quality Management Plan.

9. Reasonable Assurances

MDNR has the authority to write and enforce NPDES permits. Inclusion of a dechlorination requirement and effluent limits into a state NPDES permit, and quarterly monitoring of the effluent reported to MDNR, should provide reasonable assurance that instream water quality standards will be met.

10. Public Participation

This water quality limited segment is included on the approved 1998 303(d) list for Missouri. The MDNR Water Pollution Control Program developed this TMDL and placed it on public notice December 8, 2000. Groups receiving the public notice announcement included the Missouri Clean Water Commission, West Plains WWTP, the Water Quality Coordinating Committee, the TMDL Policy Advisory Committee, Stream Team volunteers in the watershed, and others that routinely receive the public notice of NPDES permits. Copies of the notice, any comments received and MDNR's response to comments will be on file with MDNR.

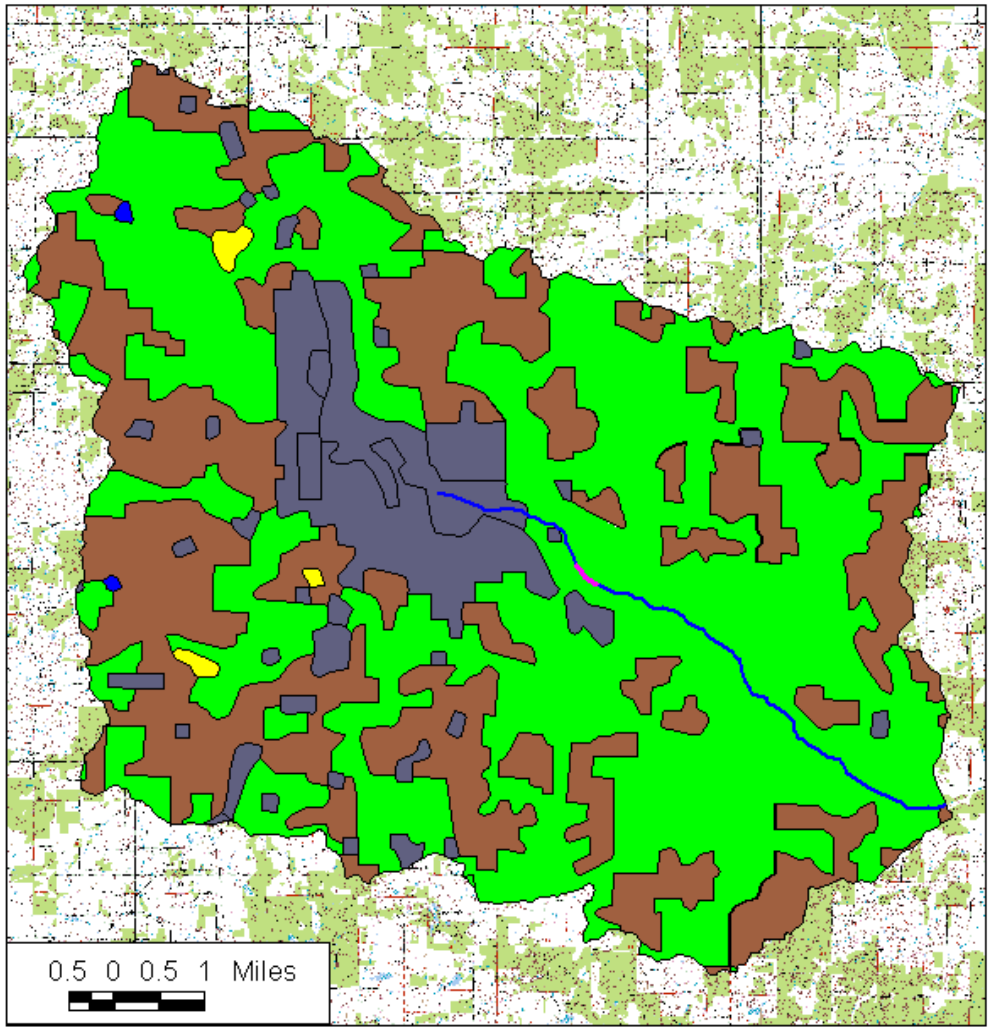
11. Appendices and List of Documents on File with MDNR

Appendix A – Land use map for the Howell Creek watershed
Appendix B – Topographic map showing WWTP location and impaired segment

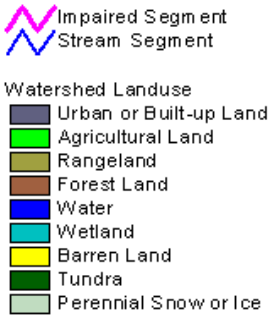
Documents on file with MDNR:

Permit for West Plains WWTP - NPDES Permit No. MO-0096610
Public notice announcement
Facts Sheet
Public comments
MDNR's response to public comments

Appendix A. Land Use Types for Howell Creek Watershed (11010010-010001)



Land Use Type		Area (acres)
Urban or Built-up Land		4898
Residential	3254	
Commercial and Services	1193	
Mixed Urban or Built-up	270	
Other Urban or Built-up	181	
Agricultural Land		22738
Cropland and Pasture	22733	
Other Agricultural Land	5	
Forest Land		14426
Deciduous Forest Land	14426	
Water		38
Reservoirs	38	
Barren Land		166
Strip Mines	143	
Transitional Areas	23	



Appendix B. Map of Impaired Stream Segment
Howell Creek, Howell County, Missouri